

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

AF/1713

In re Patent Application of

Atty Dkt. 613-55  
C# M#

RESPONSE UNDER RULE 116

FOLLESTAD, A et al.

C/A.U. 1713

EXPEDITED HANDLING PROCEDURES

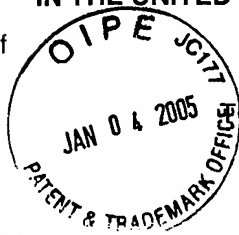
Serial No. 10/048,155

Examiner: Lu, C Caixia

Filed: May 15, 2002

Date: January 4, 2005

Title: IMPROVEMENTS IN OR RELATING TO POLYMERS



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Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

Sir:

RESPONSE/AMENDMENT/LETTER

This is a response/amendment/letter in the above-identified application and includes an attachment which is hereby incorporated by reference and the signature below serves as the signature to the attachment in the absence of any other signature thereon.

Correspondence Address Indication Form Attached.

**Fees are attached as calculated below:**

Total effective claims after amendment 0 minus highest number  
previously paid for 20 (at least 20) = 0 x \$50.00 \$0.00 (1202)/\$0.00 (2202) \$

Independent claims after amendment 0 minus highest number  
previously paid for 3 (at least 3) = 0 x \$200.00 \$0.00 (1201)/\$0.00 (2201) \$

If proper multiple dependent claims now added for first time, (ignore improper); add  
\$360.00 (1051)/\$180.00 (2051) \$

Petition is hereby made to extend the current due date so as to cover the filing date of this  
paper and attachment(s)  
One Month Extension \$120.00 (1251)/\$60.00 (2251)  
Two Month Extensions \$450.00 (1252)/\$225.00 (2252)  
Three Month Extensions \$1020.00 (1253)/\$510.00 (2253)  
Four Month Extensions \$1590.00 (1254)/\$795.00 (2254) \$

Terminal disclaimer enclosed, add \$130.00 (1814)/\$65.00 (2814) \$

Applicant claims "small entity" status.  Statement filed herewith

Rule 56 Information Disclosure Statement Filing Fee \$180.00 (1806) \$

Assignment Recording Fee \$40.00 (8021) \$

Other: Copy of Wigum et al, "Ethene Homopolymerization ...", Journal of Polymer Science: Part A: Polymer Chemistry, Vol. 38, 3161-3172 (2000). \$

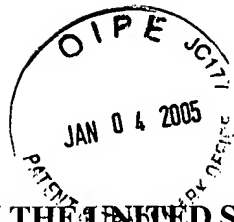
**TOTAL FEE ENCLOSED \$ 0.00**

The Commissioner is hereby authorized to charge any deficiency, or credit any overpayment, in the fee(s) filed, or asserted to be filed, or which should have been filed herewith (or with any paper hereafter filed in this application by this firm) to our Account No. 14-1140. A duplicate copy of this sheet is attached.

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NIXON & VANDERHYE P.C.  
By Atty: Arthur R. Crawford, Reg. No. 25,327

Signature:



**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

In re Patent Application of

FOLLESTAD, A. et al.

Atty. Ref.: 613-55; Confirmation No. 1492

Appl. No. 10/048,155

TC/A.U. 1713

Filed: May 15, 2002

Examiner: Lu, C Caixia

For: IMPROVEMENTS IN OR RELATING TO POLYMERS

\* \* \* \* \*

January 4, 2005

Mail Stop AF  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

Sir:

**RESPONSE TO FINAL REJECTION**

This responds to the Official Action of October 20, 2004 in which claims 1, 2 and 4-10, all of the pending claims, are rejected on the basis of a single prior art rejection.

In the Official Action, the Examiner continues to reject the claims as being "obvious" based on the assignee's own<sup>1</sup> WO 98/57998 application. In this application, a mixture of metallocene catalysts is employed in the polymerization of ethylene. In particular, the metallocene combination used is bis (n-butyl cyclopentadienyl) zirconium dichloride and dimethylsilyl bis (2-methyl-4-phenylindenyl) zirconium dichloride.

The Examiner observes that in present claim 1, applicants have restricted to the presence of a bis pentamethyl cyclopentadienyl zirconium dichloride species but argues that it is obvious to select this species given that it is disclosed in EP-A-1280245 and is a well-known metallocene anyway.

The Examiner therefore invites the presentation of unexpected results demonstrating

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<sup>1</sup> Follestad is the senior inventor in the subject application and the applied reference.

advantages of the claimed process.

The change from a single n-butyl group to five methyl groups around the cyclopentadienyl ring would not be expected to have a great effect on the polymer formed. However, the present inventors have found that this change is in fact very significant. It has surprisingly been found that the use of a bis pentamethyl cyclopentadienyl species gives approximately nine times less comonomer incorporation than a corresponding n-butyl cyclopentadienyl species.

Evidence of the type requested by the examiner is available in the attached copy of a publication from the Journal of Polymer Science which shows this effect. It is dated at least by the copyright notice in the year 2000, presumably after June 20, 2000 (acceptance date of the paper). At this moment the exact publication date is not known. The Examiner will note applicants claim benefit of July 31, 2000 for the underlying PCT application and claim benefit of a U.K. application filed (in English) of July 29, 1999. A certified copy of the U.K. application is of record as acknowledged in item 13a) 3) of Paper No. 8. Attention is directed to table 1 in this document in which a comparison of methyl cyclopentadienyl and pentamethyl cyclopentadienyl is made. As can be seen from the [H] column, the percentage of comonomer incorporated is 2.5 mol% when methylcyclopentadienyl is used as a catalyst at 0.4 mol/L hexene. The incorporation with pentamethyl cyclopentadienyl at the same concentration is only 0.3 mol %. This remarkable difference is surprising and very beneficial. In this regard, the result for a butyl as opposed to methylsubstituted cyclopentadienyl can be expected to be similar.

Since the process in claim 1 is carried out in a single reactor in the presence of two catalysts, the monomer content in the reactor cannot be adjusted to independently maximize the properties of each polymer component. For example, if a high monomer content is essential in the high molecular weight component, a high concentration of monomer is required in the reactor. However, this inevitably affects the low molecular weight component by reducing its density as it too will incorporate high levels of monomer since monomer concentration in the reactor is high.

By using the pentamethylcyclopentadienyl metallocene, the lower molecular weight, low comonomer content portion of the polymer (which is produced by the bis pentamethylcyclopentadienyl species) can be made to have a higher density, higher melting

point, higher stiffness and better environmental stress cracking resistance than a component made using a butylcyclopentadienyl.

Thus, the eventual polymer composition produced using the catalyst blend in question will have much better mechanical properties than that of a polymer produced using a blend of n-butyl cyclopentadienyl species and dimethylsilyl bis (2-methyl-4-phenylindenyl) zirconium dichloride.

The increase in density can be achieved without having to reduce the amount of comonomer present which would of course affect the higher molecular weight component being made by the other metallocene catalyst.

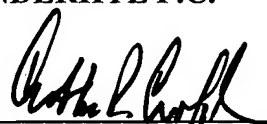
The change from n-butylcyclopentadienyl to pentamethylcyclopentadienyl also changes the vinylic content of the polymer. The n-butylcyclopentadienyl gives rise to vinyl unsaturations whereas pentamethylcyclopentadienyl gives rise to trans-vinylene unsaturations (See table 1 again). This effect, which is not linked to the incorporation of comonomer, should allow the formation of polymers with different degradation profiles allowing tailoring of polymers to particular end uses, e.g. in biodegradable applications.

For the above reasons and considering the information in the JPS article, applicants' claims are patentable. Reconsideration and favorable action are solicited.

Respectfully submitted,

**NIXON & VANDERHUYE P.C.**

By: \_\_\_\_\_

  
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